

# A Ruggedized UAS for Scientific Data Gathering in Harsh Environments, Phase II

Completed Technology Project (2017 - 2021)



## Project Introduction

Black Swift Technologies proposes the development of the SuperSwift XT, a novel small Unmanned Aircraft System that meets the sensing needs required for responding to or monitoring volcanic ash clouds. This tightly integrated system will consist of an airframe, avionics, and sensors specifically designed to measure selected gases and atmospheric properties. It is based on the commercial SuperSwift airframe and SwiftCore Flight Management System, which have been proven in the field to provide a cost-effective, powerful, and easy-to-operate solution to meet the demanding requirements of nomadic scientific field campaigns. The airframe capabilities will be expanded to achieve high altitude flights through strong winds and damaging airborne particulates. The SuperSwift's well-documented power and data interfaces will be employed to integrate the sensors required for the measurement of atmospheric volcanic phenomenon that will have broader applications for atmospheric research. The atmospheric models that are employed by dispersion studies provide information that can affect human safety. Examples not only include volcanic ash aviation hazards, but pollution alerts, toxic releases, dust storms and wildfire smoke hazards that often depend on the accuracy of these models. Accurate data input from the location as well model validation are needed for these important safety systems. Even basic atmospheric conditions such as wind and temperature are estimated or modeled from nearest weather stations that could be far from the location of interest and at limited elevations. Ground systems, manned aircraft, balloons and even dropsondes supply this data but have limitations. Satellites such as ASTER, MODIS, AIRS and OMI are invaluable but can still suffer from infrequent coverage, cloud masking and limits in resolution. The SuperSwift XT will be designed to collect data in harsh environments and will enhance the performance and utility of NASA's Airborne Science fleet

## Anticipated Benefits

In terms of addressable NASA markets, the SuperSwift XT with the custom sensor suite has several unique benefits and fulfills multiple needs of the agency. Key potential customers within the NASA Earth Science program include the Tropospheric Chemistry Program (TCP), the Applied Sciences Air Quality Program, the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission, the Aura mission, the Cloud-Aerosol Transport System (CATS), the Orbital Carbon Observatory (OCO-2/3) programs, and the Earth Ventures program for airborne field campaigns. These key potential customers would all benefit from the measurements provided by this system in various atmospheric conditions using different sensor payloads which, by design, are easily interchangeable. These key customers represent strategic activities within NASA including the Atmospheric Composition Focus Area, the Carbon Cycle & Ecosystems focus area, and the Weather focus area. Key potential customers in other government agencies include NOAA, DOE and NSF. Public entities funded by these government



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## Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Project Transitions	3
Images	3
Technology Maturity (TRL)	3
Target Destinations	3

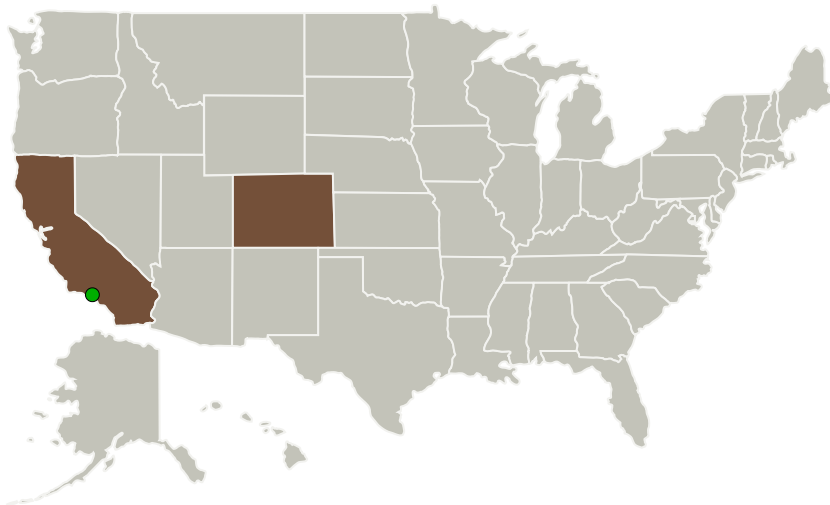
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agencies such as UCAR and NCAR are also important customers. Black Swift Technologies has engaged with multiple researchers at these organizations who are prepared to purchase commercial systems for atmospheric monitoring upon the successful completion of the Phase II work. For operational weather forecasting and monitoring the National Weather Service is expected to be a key potential partner and customer. Also, the capability of this system to operate in the hazardous environment of a volcanic plume can be utilized in wildfire monitoring and support, where particulates and severe turbulence are a regular occurrence. There is also a commercial market for the multi-hole probe sensor developed as part of this work. BST has been working with another commercial company to add it as part of their offering of atmospheric sensors for UAS. The key advantage of this new sensor is much lower cost at similar performance to existing commercial systems.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Black Swift Technologies, LLC	Lead Organization	Industry	Boulder, Colorado
 Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Black Swift Technologies, LLC

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Project Managers:

Lynn M Torres  
Carol R Lewis

### Principal Investigator:

Jack S Elston

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## Primary U.S. Work Locations

California

Colorado

## Project Transitions



**June 2017:** Project Start

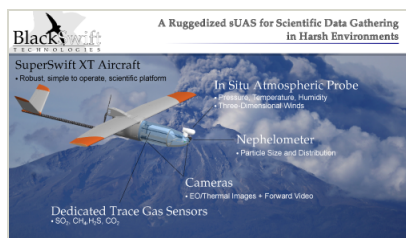


**September 2021:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141148>)

## Images



### Briefing Chart Image

A Ruggedized UAS for Scientific Data Gathering in Harsh Environments, Phase II Briefing Chart Image (<https://techport.nasa.gov/image/126322>)

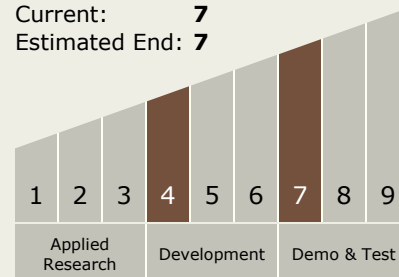


### Final Summary Chart Image

A Ruggedized UAS for Scientific Data Gathering in Harsh Environments, Phase II (<https://techport.nasa.gov/image/135242>)

## Technology Maturity (TRL)

Start: **4**  
Current: **7**  
Estimated End: **7**



## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System